

Health Behaviours, Socioeconomic Status, and Mortality: Further Analyses of the British Whitehall II and the French GAZEL Prospective Cohorts

Silvia Stringhini et al. (2011)

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Background

- Ongoing debate re relative contributions of lifestyle behaviours to health
- Lifestyle approach dominates health promotion field
- Social determinants of health often overlooked
- Critics: Nancy Krieger, Beverly Rockhill, Daniel Goldberg....

Background (continued)

- Common claim: 40% of deaths caused by preventable behaviours (McGinnis & Foege 1993; Mokdad et al. 2000)
- Widely divergent estimates of contribution of lifestyle to health inequalities
- Stringhini et al. (2011) cited estimates ranging from 12% to 72%
- Stringhini et al. (2010) found that specific health behaviours substantially attenuated influence of SES on mortality in Whitehall II, particularly when behaviours assessed repeatedly

Whitehall II study

- [1985-] health behaviours 1985-2004; mortality 1985-2009 (mean 19.5 years)
- 10,308 London civil servants (white-collar only)
- 6,895 men; 3,413 women
- 35-55 yo at baseline
- 9,771 included in this analysis (537 excluded because of missing data)
- baseline clinical examination
- baseline self-administered questionnaire: demographics, health, lifestyle factors, work characteristics, social support, life events
- periodic self-administered questionnaires?

GAZEL study

- 1989-] health behaviours 1992?-2004?; mortality 1992-2009 (mean 16.5 years)
- 20,625 employees of French national gas and electricity company Electricité de France-Gaz de France (white-collar and blue-collar)
- 15,011 men; 5,614 women
- 35-50 yo at baseline
- annual questionnaire: health, lifestyle, individual/familial/social/occupational factors, life events

Variables

- repeated measures of health behaviours (unlike most previous studies)
- approximately the same measures of SES and health behaviours in both studies
- occupational position used as marker of SES in main results
- education and income substituted in supplementary analyses

Statistical analyses

- most analyses done in each cohort separately
- age-adjusted and sex-adjusted
- calculated mortality rates per 1,000 person-years for each SES group, standardised for age and sex (direct standardisation)
- regression: prevalence rates: smoking, heavy alcohol consumption, unhealthy diet, physical inactivity
- log-binomial and logistic regression: RRs and ORs for association of SES with each health behaviour at first and last follow-up
- Cox proportional regression analysis: HRs (95% CIs):
 - association between each health behaviour (time-dependent variable) and mortality
 - association between SES and mortality
 - checked linearity, then SES used as continuous 3-level variable
 - assumed linear associations: SES and behaviours; SES and mortality

Findings

- smoking and unhealthy diet declined in both cohorts, particularly GAZEL
- physical inactivity increased in both cohorts
- heavy drinking increased in Whitehall high-SES participants
- baseline: unhealthy behaviours (apart from heavy drinking) more prevalent in lowest SES than highest, in both cohorts
- last follow-up Whitehall: great inequalities persisted in smoking, unhealthy diet, physical inactivity
- last follow-up GAZEL: only small differences except for physical inactivity
- significant associations between smoking, diet, physical activity in both cohorts
- alcohol a bit less clear-cut

Figure 1. Prevalences of unhealthy behaviours at baseline and last follow-up

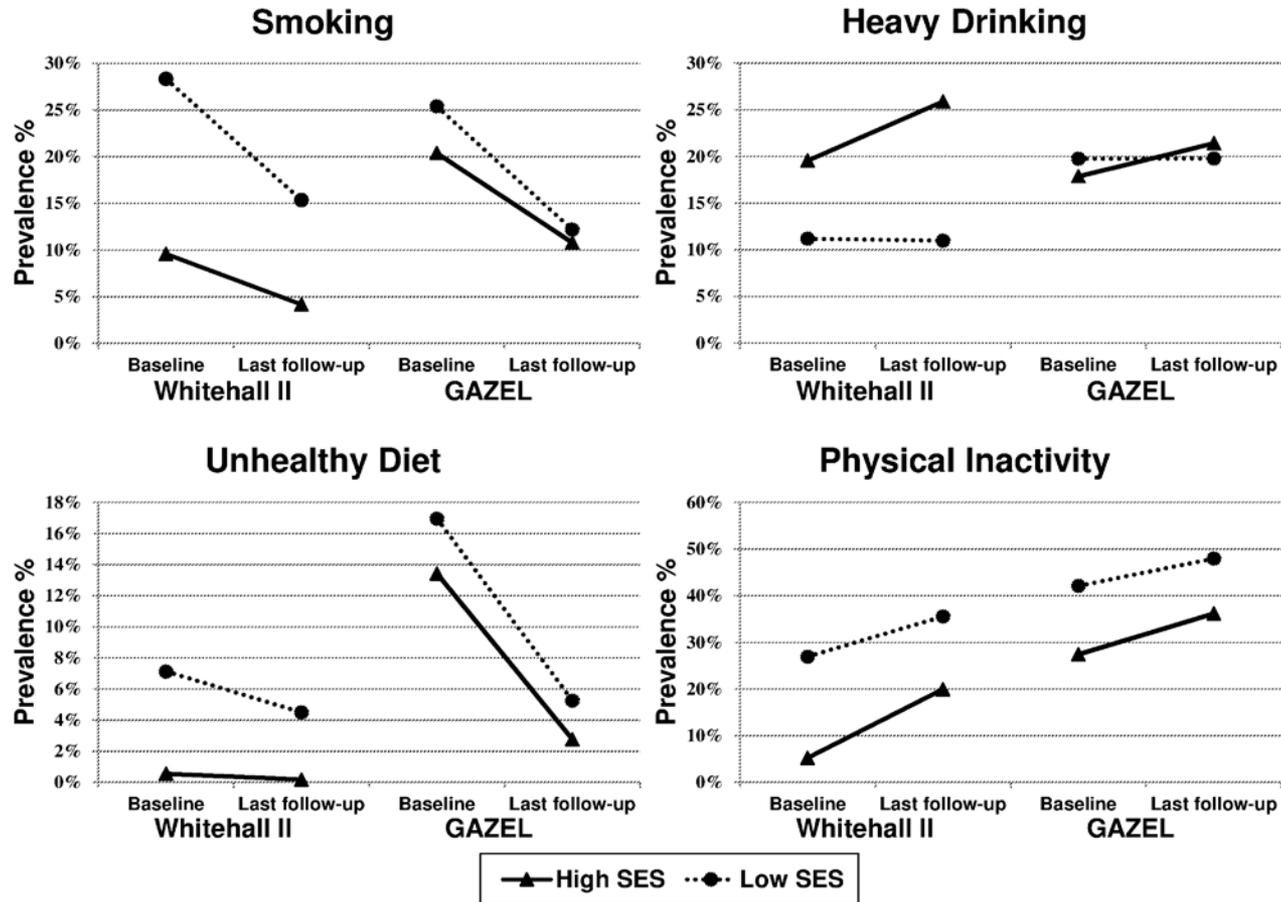


Table 3. Association between health behaviours and mortality

Health Behaviours	Whitehall II	GAZEL	<i>p</i> ^d
	HR (95% CI) ^a	HR (95% CI) ^a	
Smoking			
Nonsmokers	1.00	1.00	
Current smokers	2.38 (1.99–2.85)	2.10 (1.81–2.43)	0.36
Drinking			
Abstainers	1.56 (1.30–1.87)	1.88 (1.58–2.24)	
Moderate drinkers	1.00	1.00	
Heavy drinkers	1.25 (1.02–1.52)	1.16 (0.99–1.36)	0.70
Diet			
Healthy	1.00	1.00	
Moderately healthy	1.41 (1.20–1.65)	1.17 (0.99–1.38)	
Unhealthy	2.14 (1.49–3.07)	2.04 (1.61–2.60)	0.49
Physical activity			
Active	1.00	1.00	
Moderately active	1.05 (0.86–1.30)	1.23 (1.02–1.48)	
Inactive	1.60 (1.34–1.90)	1.68 (1.44–1.96)	0.45

^aModel adjusted for age at baseline and sex.

^b*p* for interaction between health behaviour and cohort.

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Modelling

- model 1: adjusted for baseline age and sex
- model 1 + smoking: 32%, 4% attenuation (Whitehall/GAZEL)
- model 1 + alcohol: 14%, 7%
- model 1 + diet: 25%, 4%
- model 1 + physical activity: 21%, 8%
- model 1 + all health behaviours: 75%, 19%

- key finding: combined health behaviours attenuated association between SES and mortality 75% in Whitehall II but only 19% in GAZEL

Table 4. Role of health behaviours (time-dependent covariate) in explaining association between occupational position and mortality

Model	Whitehall II		GAZEL	
	HR (95% CI)	Percent Δ (95% CI) ^{a,b}	HR (95% CI)	Percent Δ (95% CI) ^{a,b}
Model 1 ^c	1.62 (1.28–2.05)		1.94 (1.58–2.39)	
Model 1+ smoking	1.39 (1.09–1.75)	32 (20–62)	1.89 (1.54–2.32)	4 (2–8)
Model 1+ alcohol	1.52 (1.19–1.93)	14 (3–37)	1.85 (1.51–2.28)	7 (4–11)
Model 1+ diet	1.44 (1.13–1.83)	25 (3–37)	1.89 (1.54–2.33)	4 (2–8)
Model 1+ physical activity	1.47 (1.16–1.86)	21 (11–43)	1.84 (1.50–2.27)	8 (4–12)
Fully adjusted model ^d	1.13 (0.88–1.44)	75 (44–149)	1.71 (1.39–2.10)	19 (13–29)

^aPercent attenuation in log HR = $100 \times (\beta_{\text{Model 1}} - \beta_{\text{Model 1+ health behaviour(s)}}) / (\beta_{\text{Model 1}})$, where $\beta = \log(\text{HR})$.

^bBias corrected accelerated bootstrap 95% CI.

^cHR for lowest versus highest occupational position adjusted for age at baseline and sex.

^dHR for lowest versus highest occupational position adjusted for age at baseline, sex, and all health behaviours.

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Table 5. Contribution of health behaviours in explaining social gradient in mortality

Study	HR (95% CI) ^a	Smoking ^b	Drinking ^b	Diet ^b	Physical activity ^b	All behaviours ^b
Whitehall II						
Occupational position (<i>n</i> = 9,771)	1.62 (1.28–2.05)	32%	14%	25%	21%	75%
Education (<i>n</i> = 9,754)	1.43 (1.15–1.79)	31%	7%	21%	8%	56%
Income (<i>n</i> = 9,671)	1.90 (1.49–2.41)	26%	10%	16%	19%	56%
GAZEL						
Occupational position, whole cohort (<i>n</i> = 17,760)	1.94 (1.58–2.39)	4%	7%	4%	8%	19%
Occupational position, white-collar workers only (<i>n</i> = 8,079)	2.26 (1.63–3.13)	3%	7%	4%	5%	17%
Education (<i>n</i> = 17,449)	1.56 (1.26–1.91)	3%	4%	7%	7%	17%
Income (<i>n</i> = 17,131)	2.05 (1.60–2.63)	4%	7%	5%	10%	23%

In Whitehall II, education categorized as university, secondary, and primary education was collected at phase 5 (1997–1999) and was available on 6,776 participants. The remaining participants, *n* = 2,978, were imputed using multiple imputation. Income was not available at study baseline (1985–1988). We thus use a proxy measure composed of measures of car ownership and type of accommodation. The highest category represents participants owning a car and their house, the lowest represents participants not owning a car and living in rented accommodation. The intermediate category represents other combinations of car ownership and type of accommodation. In the GAZEL study education and income were collected at study baseline (1989). Education was categorized as university, secondary, and primary education. For income, the following three categories (based on quintiles of income, converted in Euro from French Francs) were used in the analysis: <1,600€, 1,600€–3,800€, and ≥3,800€.

^aHR for lowest versus highest occupational position adjusted for age at baseline and sex.

^bPercent attenuation in log HR = $100 \times (\beta_{\text{Model 1}} - \beta_{\text{Model 1+ health behaviour(s)}}) / (\beta_{\text{Model 1}})$, where $\beta = \log(\text{HR})$.

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Stringhini et al.'s conclusions

- health behaviours strong predictors of mortality in both Whitehall and GAZEL
- but association with SES remarkably different in the two cohorts
- health behaviours are likely to be major contributors of socioeconomic differences in health ***only in contexts with marked social characterisation of health behaviours***

Strengths of study

- rigorous studies
- compatibility of studies
- largeish cohorts
- long follow-up
- repeated measures of health behaviours

Weaknesses of study

- Possible confounding
- Did not consider material and psychosocial factors
- Lack of representativeness of general population:
 - occupational cohorts
 - all participants in stable employment
 - Whitehall II study only white-collar

Further reading

- Stringhini S, Dugravot A, Shipley M, Goldberg M, Zins M, Kivimäki M, Marmot M, Sabia S, Singh-Manoux A. Health Behaviours, Socioeconomic Status, and Mortality: Further Analyses of the British Whitehall II and the French GAZEL Prospective Cohorts. PLoS Med. 2011 Feb;8(2):e1000419.
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